

# Nutrient Management Issues Associated with Covered Anaerobic Lagoons

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# How does a cover affect function and characteristics of an anaerobic lagoon?

- Especially: What is the impact on nitrogen levels in the lagoon liquid?

1. We don't know.
2. We can make some estimates based on experience with similar systems.
3. We plan to find out.

**We can make some estimates based on experience with similar systems.**

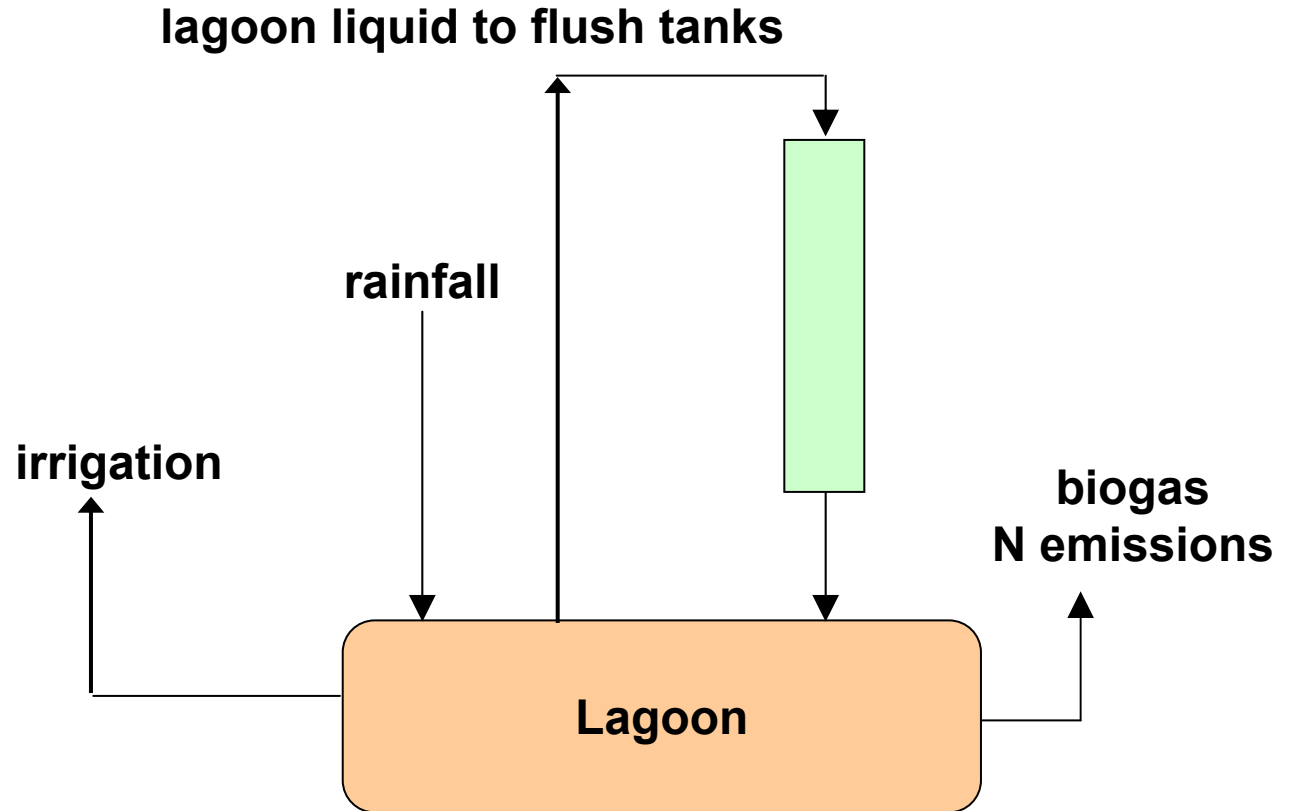
- Traditional lagoon with permeable cover
- Barham Farm ambient temperature anaerobic digester

# Swine Lagoon with Permeable Cover

- Traditional lagoon in Onslow County, 0.4 ha ( ~1 acre)
- Permeable cover was installed in August, 2000
- “Control” lagoon on the same farm was not covered

# Swine Lagoon with Permeable Cover

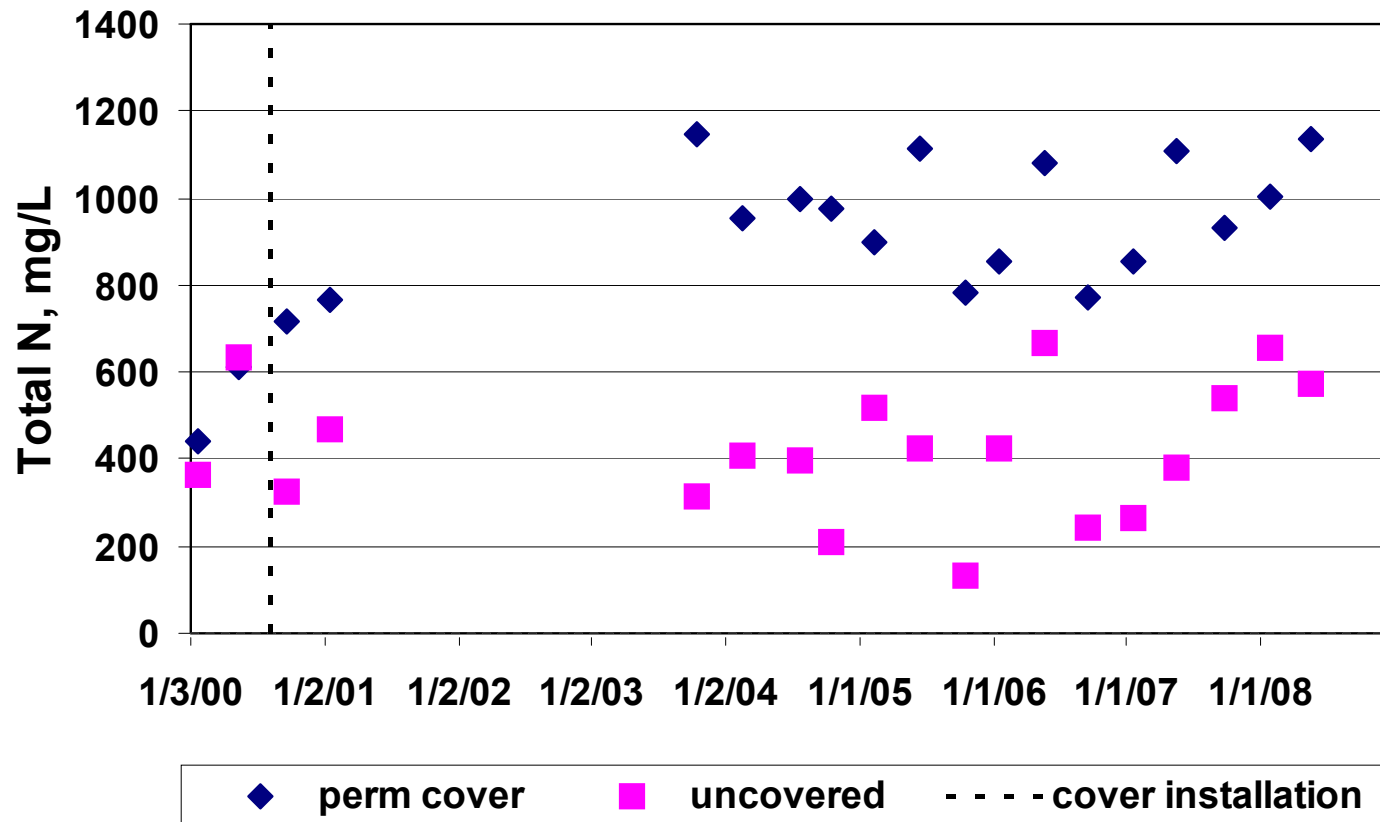
(two lagoons on the farm, one covered one not covered)





# Swine Lagoon with Permeable Cover

## Total Nitrogen





# Swine Lagoon with Permeable Cover

## Similar Lagoon on Same Farm

(NCDA Sample Data)

Pre-Cover  
TKN = 525 mg/l

Permeable  
Covered  
Lagoon

Post-Cover  
TKN = 946 mg/l

TKN = 498 mg/l

Uncovered  
Lagoon

TKN = 409 mg/l

Compare to lagoons:

Pre-Cover: both slightly under NC Lagoon Average

Post-Cover: TN = 946 mg/l

NC Lagoon Average: 565 mg/L (~1.7 X)

# Swine Lagoon with Permeable Cover

## Similar Lagoon on Same Farm

(NCDA Sample Data)

Pre-Cover  
TKN = 525 mg/l

Permeable  
Covered  
Lagoon

Post-Cover  
TKN = 946 mg/l

**TN Change = 1.8 X (increase)**

TKN = 498 mg/l

Uncovered  
Lagoon

TKN = 409 mg/l

Pre-Cover Difference:  
**1.05 X**

Post-Cover Difference:  
**2.3 X**

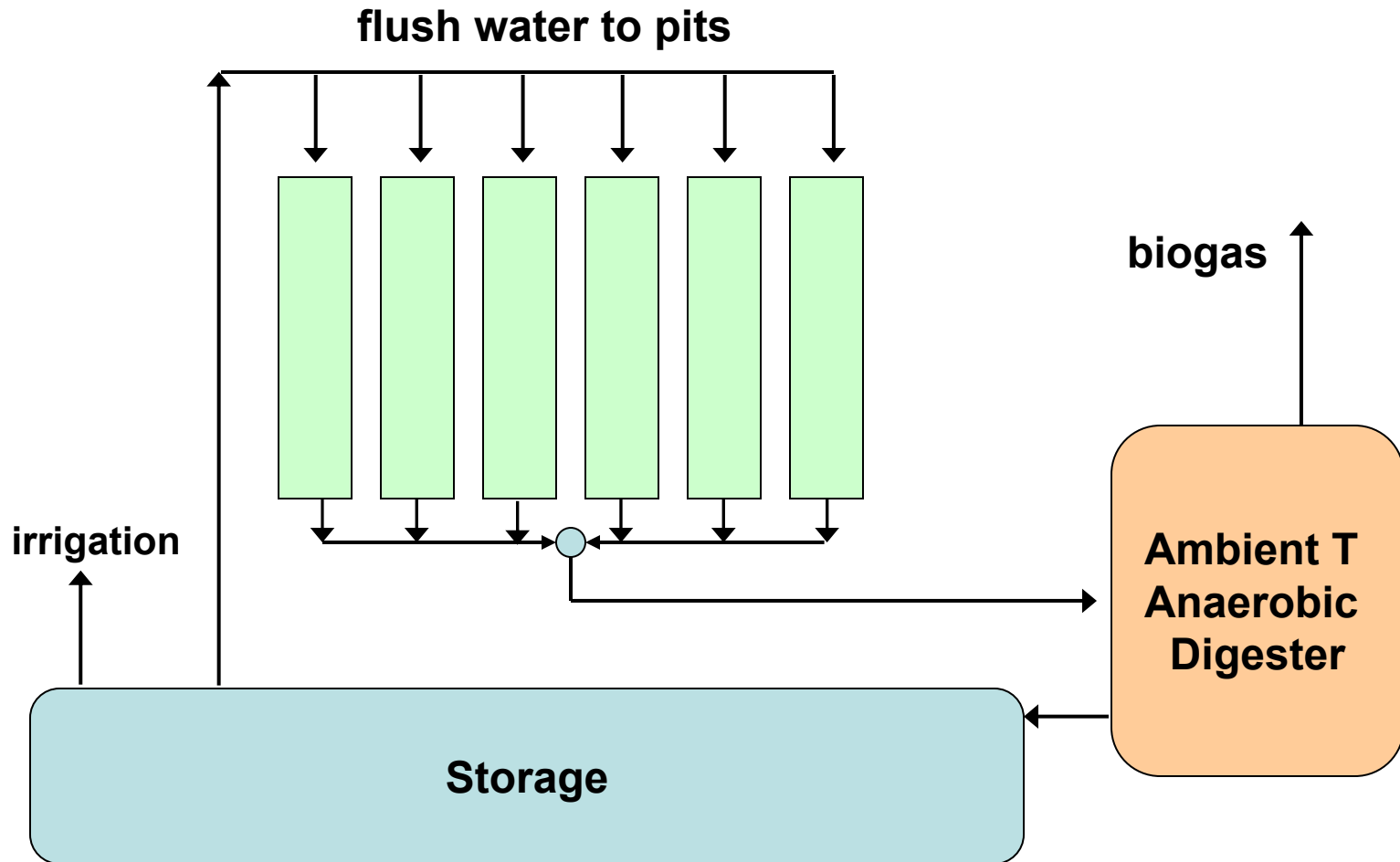
# **Barham Farm Anaerobic Digester**

- In-ground, ambient temperature digester
- Retention time ~150 days

Reference: Phase I: Technology Determinations Report

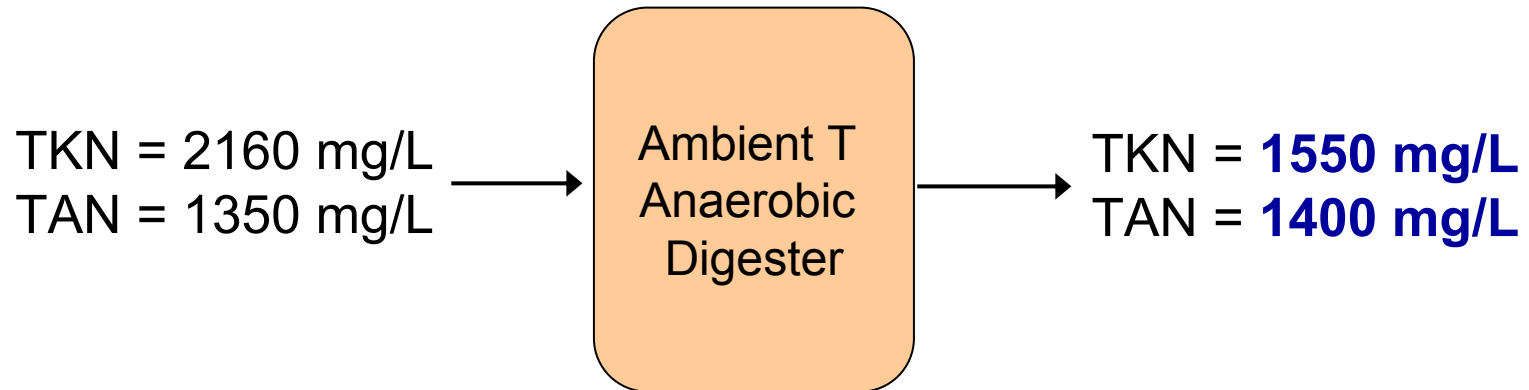
[http://www.cals.ncsu.edu/waste\\_mgt/smithfield\\_projects/phase1report04/phase1report.htm](http://www.cals.ncsu.edu/waste_mgt/smithfield_projects/phase1report04/phase1report.htm)

# Barham Farm Anaerobic Digester





## Barham Farm Anaerobic Digester



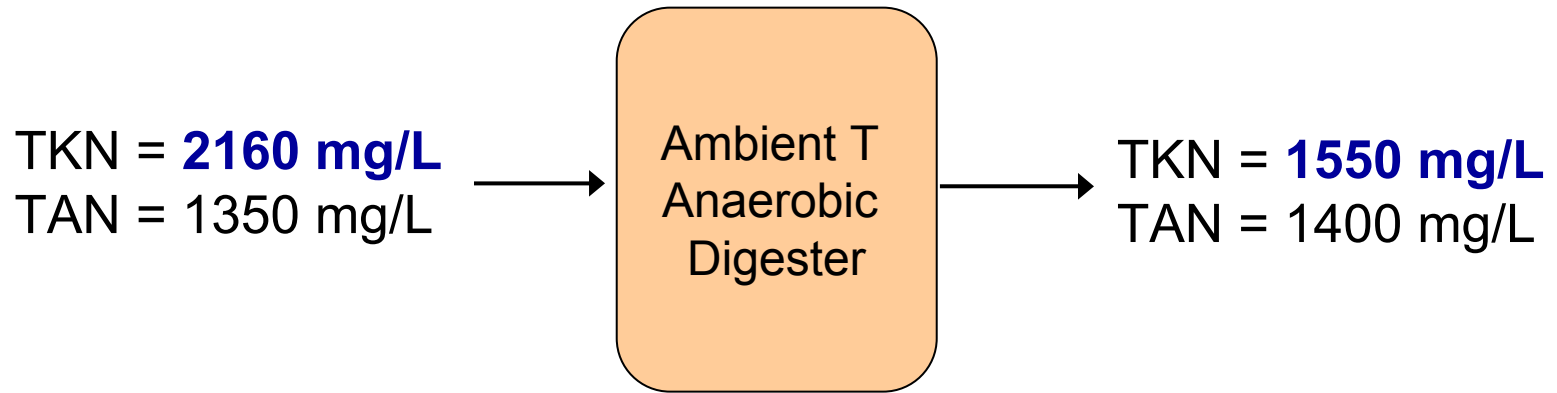
Compare to lagoons:

Digester Effluent: 1550 mg/L TN

Storage Lagoon: 389 mg/L (~4 X)

NC Lagoon Average: 565 mg/L (~2.7 X)

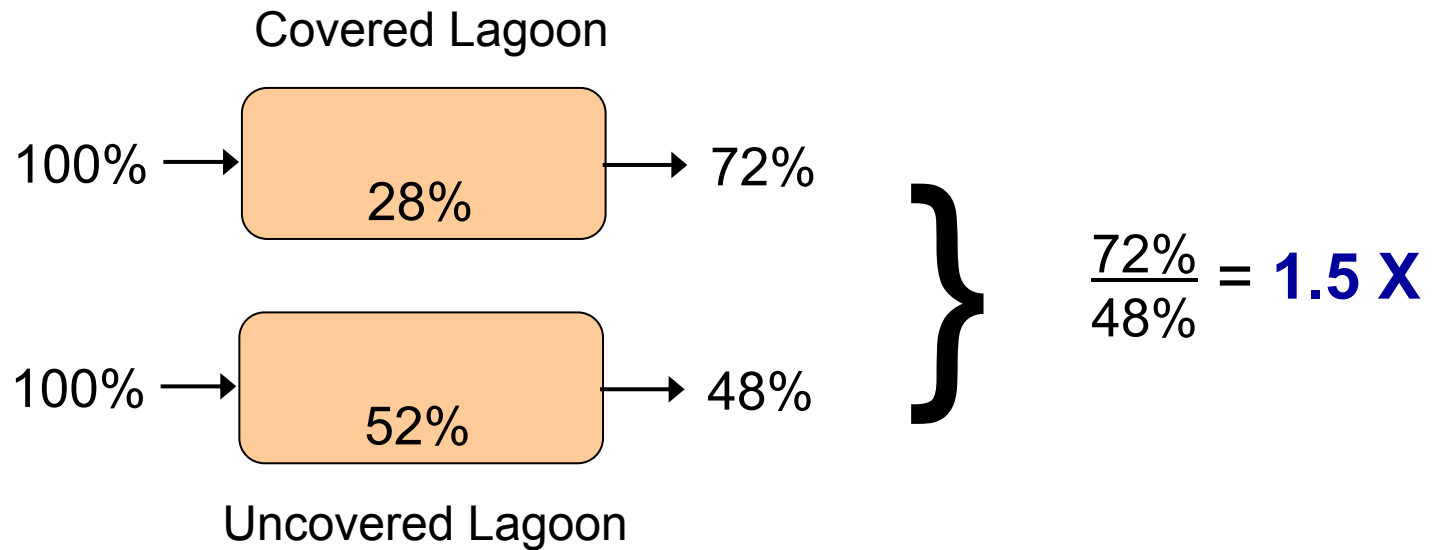
# Barham Farm Anaerobic Digester



**TN removal = 28%**

Compare:

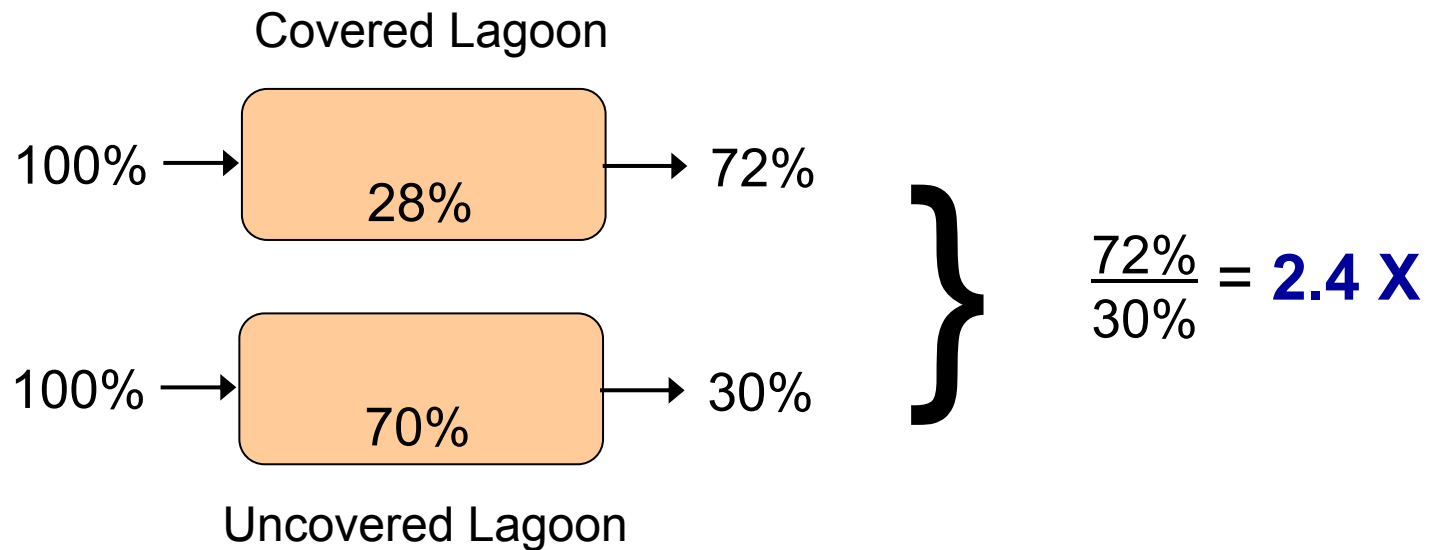
Uncovered lagoons: 50 – 70% N removal





Compare:

Uncovered lagoons: 50 – 70% N removal



# Areas of Research Needs

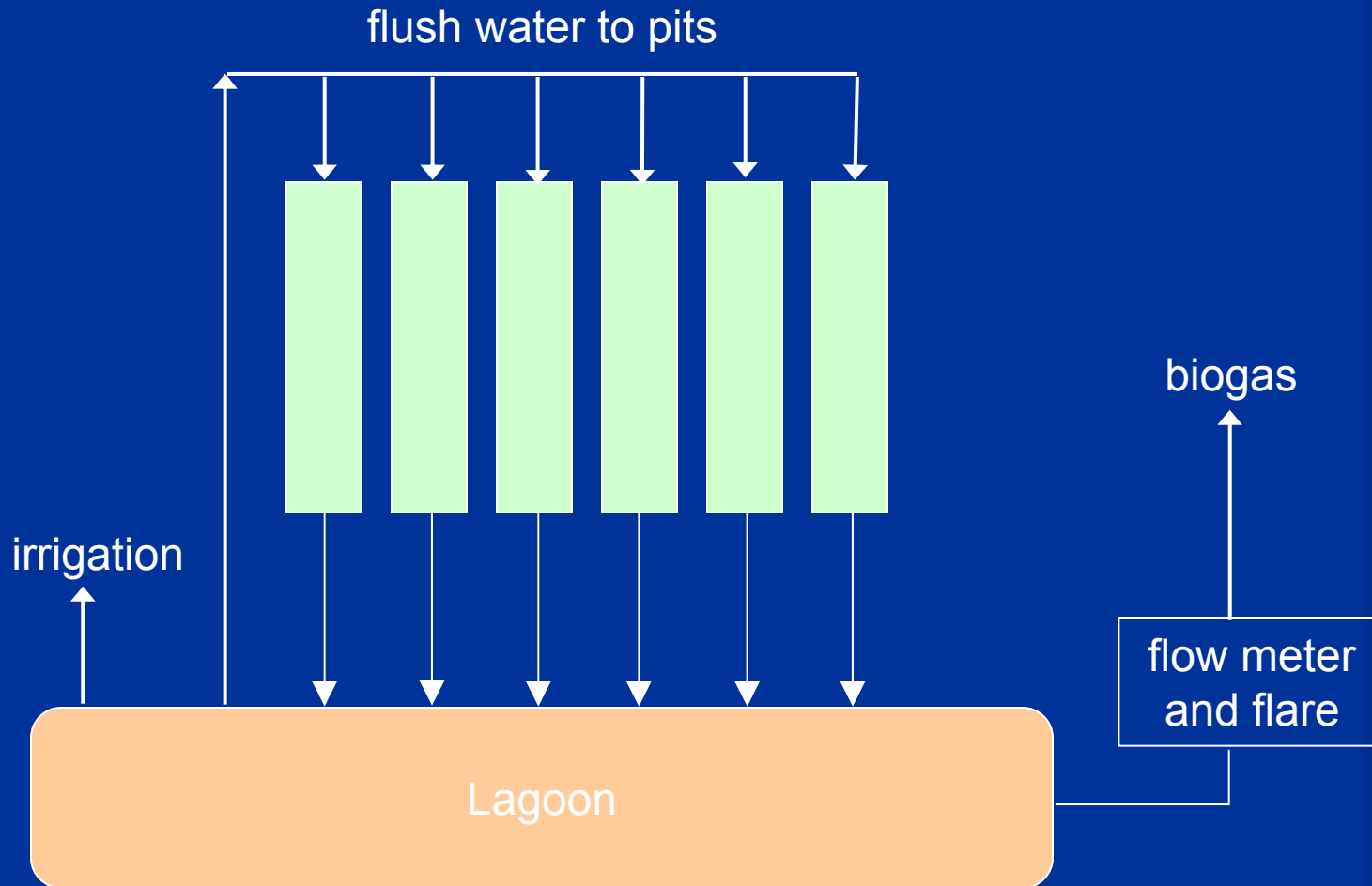
(What's going on under the covers?)

The current North Carolina Pork Council funded project is designed to answer a few basic questions:

- ✓ What are the nitrogen dynamic when a cover is placed on an existing single stage lagoon?
- ✓ What is the fate of the increased nitrogen concentration in the covered lagoon liquid?
- ✓ What effects do covers have on sludge accumulation rates?

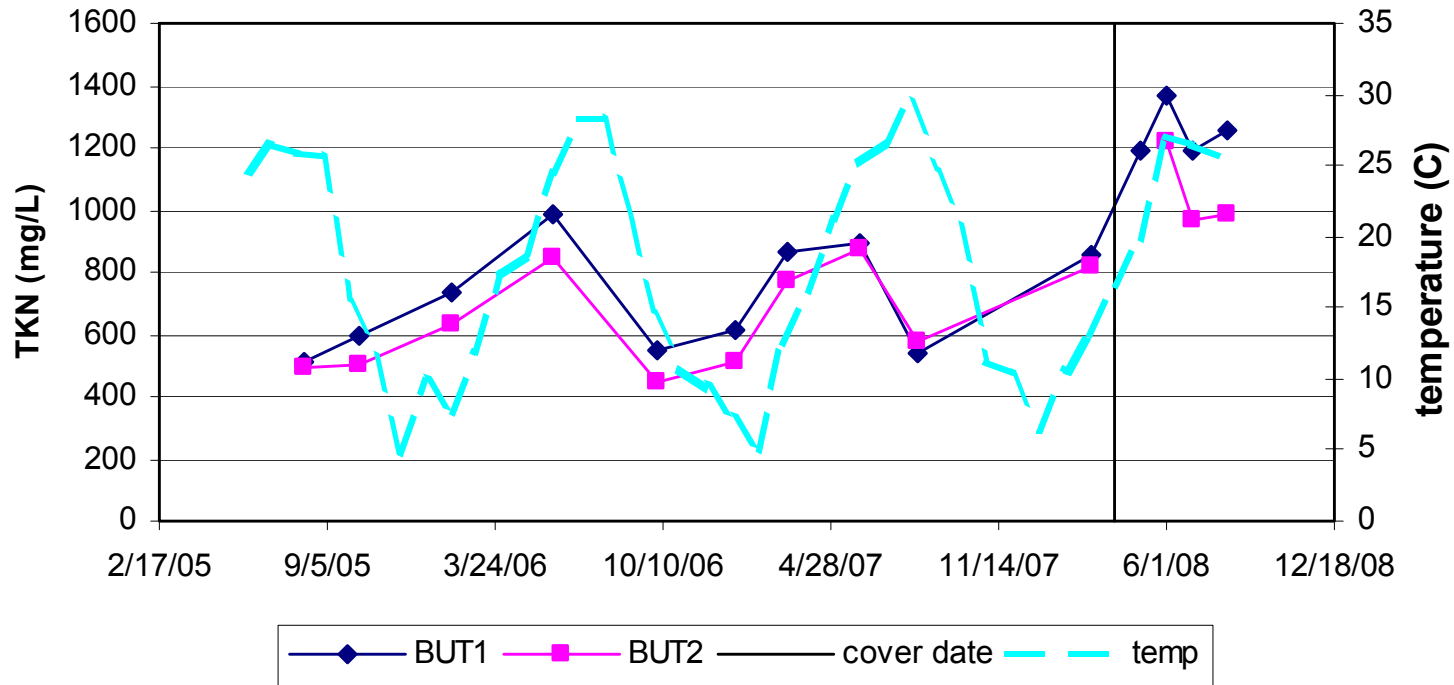


# Typical EEC Covered Swine Lagoon





## Butler Farm



## Average of 4 EEC Covered Swine Lagoons

Pre-Cover  
TKN = 603 mg/L

Covered  
Lagoon

Post-Cover  
TKN = 1,091 mg/l

Compare to lagoons:

Pre-Cover: ~NC Lagoon Average

Post-Cover: TKN = 1,091 mg/l

NC Lagoon Average: 565 mg/L (~1.9 X)

## Average of 4 EEC Covered Swine Lagoons

Pre-Cover  
TKN = 603 mg/L

Covered  
Lagoon

Post-Cover  
TKN = 1,091 mg/L

**TN Increase = 1.8 X**



# Areas of Research Needs

(What's going on under the covers?)

- Is there an increase in hydrogen sulfide levels in the lagoon?
- What effects does using covered lagoon liquid for barn flushing have on animal health and barn emissions?
- What are the impacts of irrigating lagoon liquid with higher nitrogen (ammonia) concentration?
- Are there changes in nutrient availability in the lagoon liquid?
- Are there shifts in microbial communities in the lagoon?





Questions?

